

void ratio. Further details regarding Applicants' arguments and the Examiner's response are provided in the discussions regarding the prior art rejections, as set forth below.

**Rejections Under 35 U.S.C. § 102(b) and § 103(a)**

I. Claims 1-3, 8-11, 13, 19-26, 32-37, 39-41 and 43 are rejected under 35 U.S.C. § 102(b) as being anticipated by Resasco et al. (U.S. 6,413,487) in view of Kim et al. (*Synthesis and Pore Size Control of Cubic Mesoporous Silica SBA-1*, Chem. Mater. 1999; 11: 487-497).

II. Claim 28 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Resasco et al. and Kim, and further in view of Baker (U.S. 5,618,875) to show a state of fact.

III. Claim 28 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Resasco et al. and Kim, and further in view of Baker.

IV. Claims 15-18 and 44-47 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Resasco et al. and Kim, and further in view of Margrave et al. (U.S. 6,645,455).

V. Claims 12 and 42 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Resasco et al. and Kim, and further in view of Smalley et al. (U.S. 6,761,870).

VI. Claim 27 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Resasco et al. and Kim, and further in view of Yamada et al. (U.S. 5,102,647).

Each of these rejections is respectfully traversed.

**The Position of Applicants**

Applicants' claim 1 requires a method for producing carbon nanofibers, comprising causing the carbon nanofibers to grow on surfaces of closely packed fine particles, wherein a void ratio of each of the closely packed fine particles is 10% or less, recovering the closely packed fine particles, and separating the carbon nanofibers from the surfaces of the closely packed fine particles by a physical process to recover the carbon nanofibers.

Thus, **the void ratio of the closely packed fine particle in Applicants' invention is defined as 10% or less**, regardless of the material thereof, and the particle is **closely packed**, i.e., of high strength. (See page 10, line 19 to page 11, line 9 of Applicants' original specification.) Thus, it is possible to prevent a part of the surface of the support (the fine

particle) from being peeled off together with the carbon nanotube (CNT), when the CNT is physically separated from the surface of the catalyst support (page 11, lines 6 to 9).

More specifically, when the void ratio of the support is high, (and thus outside the scope of Applicants' claims), some CNT grows from inside the support. Then, when separating this CNT, a part of the support is also peeled off.

On the contrary, in the present invention, the void ratio of the support is set to a low level of **10% or less**, thereby making the CNT to grow on the surface of the support. [As set forth in claim 10, a catalyst may be adhered to the closely packed fine particles.] Thus, peeling-off of the support is prevented, and the yield of the CNTs are improved.

The Examiner agrees that the primary reference (Resasco) fails to teach void ratio. The Examiner relies upon Kim as "[providing] teachings of how to modify pore size and in turn surface area/void ratio." Applicants respectfully disagree with the Examiner's position. Specifically, Applicants assert that the teachings of Kim do not remedy the deficiencies of the primary reference.

Kim discloses a relation between the change in **pore size** and adsorption of gas. As mentioned by the Examiner in the Office Action, Kim does disclose the pore size and the surface area size. However, Kim does not provide any disclosure or suggestion regarding "void ratio". Kim is merely a reference disclosing one manner of controlling the pore size and the surfactant, and the reference focuses mostly on the pore size of a pore formed in a particle, the specific surface area, and the like. Kim does not provide any disclosure regarding the particle required by Applicants' claims.

The Examiner asserts that a "low void ratio (*i.e.* few voids or pores) would give rise to a lower surface area, and vice versa." However, Applicants' invention does not mention **pore size**, but rather is characterized by a distinct **void ratio**, which enables the prevention of flaking of a fine particle while carbon nanofibers are separated from the fine particle, whereby carbon nanofibers containing no impurities can be obtained.

In Fig. 22(a) of the present specification, a fine particle 50 has a void ratio of 10% or less, and the carbon nanofibers 52 can grow from the surface of the fine particle 50 with easy separation. As a result, the carbon nanofibers grow and obtain high purity. On the other hand, in Fig. 22(b), a porous fine particle 80 has a high void ratio greater than 10%, and the surface of the

porous fine particle 80 and the carbon nonfibers 52 peel off, and affect the purity of the carbon nanofibers 52. As a result, the porous fine particle 80, having a void ratio greater than 10%, results in growing carbon nanofibers with low purity. Thus, Applicants have demonstrated the unexpected advantage achieved by the claimed invention.

In the present invention, void ratio is an index for indicating the degree of the particle's close packing. However, from the disclosure of the pore size and the surface area by Kim, one of ordinary skill in the art would not be motivated to provide a closely packed particle having a low void ratio of 10% or less, resulting in a closely packed (highly densified) particle, which minimizes impurities resulting from peeling-off at the time of separation of a CNT formed on the surface of the closely packed fine particle.

For the reasons provided above, Applicants assert that the subject matter of the present invention is patentable over the teachings of Resasco in view of Kim. The additional references relied upon in the remaining rejections fail to remedy the deficiencies of Resasco and Kim.

In view of the above remarks, Applicants respectfully request that each of the above rejections be withdrawn.

**Conclusion**

Therefore, in view of the foregoing amendments remarks, it is submitted that each of the grounds of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

If, after reviewing this Response, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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